REMARKS

Claims 6, 7, and 45 having previously been withdrawn, claims 1, 8, 11-15, 16-23, 28-36, 39-47, 50, 51, and 53-55 are pending, with claims 1, 8, 16, 29, 42 and 46 being independent. Reexamination and reconsideration are respectfully requested.

Initially, Applicants would like to thank the Examiner for the indication that claims 28, 39, 40, 43, 50, 54, and 55 contain allowable subject matter.

The rejections of **(1)** claims 1, 16, 18, 20, 46, and 53 over U.S. Patent Application Publication No. 2002/0137239 ("Koyanagi") in view of U.S. Patent No. 6,245,616 ("Buchanan"), **(2)** claims 8, 11, 12, 17, 19, and 47 over Koyanagi in view of Buchanan and further in view of U.S. Patent No. 6,497,783 ("Suzuki"), **(3)** claims 13-15 over Koyanagi, Buchanan, and Suzuki and further in view of U.S. Patent Application Publication No. 2001/0036752 ("Deboer"), **(4)** claims 21-23 and 51 over Koyanagi in view of Buchanan and further in view of Deboer, **(5)** claims 29 and 42 over Koyanagi in view of Buchanan and further in view of U.S. Patent No. 6,436,777 ("Ota"), **(6)** claims 30 and 31 over Koyanagi, Buchanan, and Ota and further in view of Suzuki, **(7)** claims 32-36 over Koyanagi, Buchanan, and Ota and further in view of Deboer, and **(8)** claims 41 and 44 over Koyanagi, Buchanan, and Ota and further in view of U.S. Patent No. 6,228,779 ("Bloom"), are respectfully traversed in view of the following remarks.

As recited in independent claims 1, 8, 16, 29, 42 and 46, the present invention, among other things, relates to a method for forming an underlying film by irradiating the surface of an insulating film disposed on an electronic device substrate with ***plasma*** (oxygen radicals), wherein the underlying film is an oxide film, and has a thickness of 6-12 Å..

The Office Action cites Koyanagi as disclosing,

> [A] method for forming an underlying film, comprising: irradiating the surface of an insulating film 2 disposed on an electronic device substrate 1 with plasma based on a process gas comprising at least on oxygen atom-containing gas (page 4, paragraph 46), to thereby form an underlying film 3 at the interface between the insulating film and the electronic device substrate (page 4, paragraph 46, see fig. 1C), wherein the underlying film is an oxide film (page 4, paragraph 46).

(Page 3). The Office Action acknowledges that Koyanagi fails to disclose "wherein the oxide film has a thickness of 6-12 Å." (Page 3). Accordingly, the Office Action discloses Buchanan as disclosing,

> [A]fter an oxynitride film 22 is formed, an oxide spacer layer 32 is formed between the oxynitride film and a silicon substrate 12 by a plasma CVD process (col. 6, lines 15-38; see fig. 2B). And the oxide spacer has a thickness between about 1 Å and about 40 Å (col. 4, lines 5-8).

(Page 4). The Office Action asserts,

> At the time of the invention it would have been obvious to a person of ordinary skill in the art to use a certain thickness of an underlying oxide, as taught by Buchanan, because it would have been to obtain a desired oxide film without any leakage while keeping reduced size of a device.

(Page 4).

While Buchanan discloses a CVD process such as plasma CVD, remote plasma CVD, rapid thermal CVD or low pressure CVD, the CVD process is used to form an oxynitride film (an insulating film), rather than an underlying film. Buchanan discloses a process for creating an oxide spacer layer 32 underneath the oxynitride film layer 22 by ***re-oxidizing*** a silicon substrate 12 at an elevated temperature, *i.e.*, between about 500°C and about 1200°C. (Column 6, Lines 28-34). Buchanan does not disclose or suggest a method for forming an underlying film by irradiating the surface of an insulating film disposed on an electronic device substrate with ***plasma***.

The method that Buchanan discloses for re-oxidizing a silicon substrate at an elevated temperature to create an oxide spacer layer is generally referred to as "thermal annealing". Thermal annealing is quite different from the presently claimed plasma process. For example, with regard to controlling the thickness of the underlying film (an oxide spacer layer), the plasma process is superior to thermal annealing because the plasma process can be accomplished under low temperature. Thus, an underlying film with a thickness of 6-12 Å can be achieved by the presently claimed plasma process. In contrast, Applicants respectfully submit that forming an underlying film with a thickness of 6-12 Å by the thermal annealing method disclosed by Buchanan can be very difficult because the re-oxidizing is performed at a relatively high temperature, *i.e.*, between about 500°C and about 1200°C.

As Buchanan does not disclose or suggest a plasma process for forming an underlying film, Applicants respectfully submit that the proposed combination of Koyanagi and Buchanan does not disclose or suggest, *inter alia,* a method for forming an underlying film by irradiating the surface of an insulating film disposed on an electronic device substrate with plasma (oxygen radicals), wherein the underlying film is an oxide film, and has a thickness of 6-12 Å.

Moreover, the above-noted deficiencies of Koyanagi and Buchanan are not remedied by any of Suzuki, Deboer, Ota, or Bloom. In particular, none of (1) Koyanagi in view of Buchanan and further in view of Suzuki, (2) Koyanagi, Buchanan, and Suzuki and further in view of Deboer, (3) Koyanagi in view of Buchanan and further in view of Deboer, (4) Koyanagi in view of Buchanan and further in view of Ota, (5) Koyanagi, Buchanan, and Ota and further in view of Suzuki, (6) Koyanagi, Buchanan, and Ota and further in view of Deboer, or (7) Koyanagi, Buchanan, and Ota and further in view of Bloom, discloses or suggests a method for forming an underlying film by irradiating the surface of an insulating film disposed on an electronic device substrate with plasma (oxygen radicals), wherein the underlying film is an oxide film, and has a thickness of 6-12 Å.

Moreover, as previously explained in the Reply filed May 13, 2008, Applicants' invention achieves unexpected results based on the claimed thickness range relative to the prior art, as discussed below.

Fig. 14 shows a change in the electrical film thickness (Teq) of an insulating film (HfSiO) and an oxide film (SPAOx) fabricated under the insulating film with respect to the oxidation time. Fig. 15 shows uniformity in the electrical film thickness with respect to the oxidation time. As can be seen from Fig. 15, the uniformity in the electrical film thickness ("Range") of 1-2.5 Å is preferred and the corresponding oxidation time is 20-70 sec. Next, an oxide film thickness of the oxide film fabricated by an oxidation time of 20 sec. and 70 sec. will be obtained with Fig. 14.

In Fig. 14, the vertical axis shows the total film thickness (HfSiO + SPAOx) of an insulating film (HfSiO) and the oxide film (SPAOx) fabricated under the insulating film. As shown in Fig. 14, the total film thickness is about 22 Å at 20 sec of oxidation time and the total thickness is about 28 Å at 70 sec. of oxidation time. The thickness of the initial insulating film before oxidation is 16 Å as can be seen from the thickness at the oxidation time 0 sec. Accordingly, the oxide film thickness at the oxidation time 20 sec. is 6 (=22-16) Å and the oxide film thickness at the oxidation time 70 sec. is 12 (=28-16) Å. Therefore, as can be seen from the experimental results shown in Figs. 14 and 15, the oxidation film thickness 6-12 Å can achieve an excellent uniformity of the oxidation film fabricated between a substrate and the insulating film. The uniformity has an important beneficial effect on the electrical properties of an electrical device.

Accordingly, Applicants' claimed range of oxide film thickness of 6-12 Å of the present invention can achieve the remarkable and unexpected effect with respect to improving the electrical properties of an electrical device.

In view of the above, Applicants respectfully submit the claims are patentable over the art of record. While Applicants gratefully acknowledge the indicated allowability of certain dependent claims, for the foregoing reasons, Applicants respectfully submit all claims are now allowable over the art of record. An early notice to that effect is solicited.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #101249.55458US).

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